

10. 525.332  
09.07.05

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property  
Organization  
International Bureau



(43) International Publication Date  
20 March 2003 (20.03.2003)

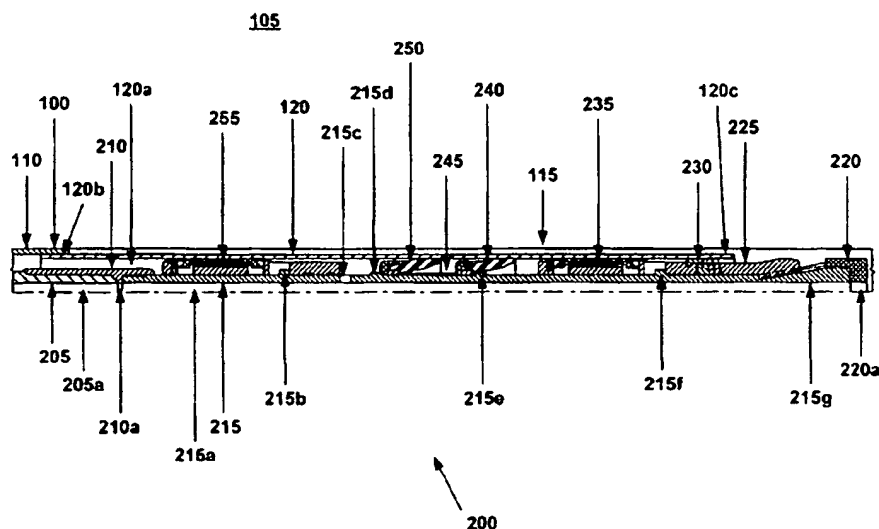
PCT

(10) International Publication Number  
WO 2003/023178 A3

- (51) International Patent Classification<sup>7</sup>: E21B 43/10
- (21) International Application Number: PCT/US2002/025608
- (22) International Filing Date: 13 August 2002 (13.08.2002)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 60/318,021 7 September 2001 (07.09.2001) US
- (71) Applicant (for all designated States except US): ENVEN-  
TURE GLOBAL TECHNOLOGY [US/US]; 16200 A.  
Park Row, Houston, TX 77084 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): RING, Lev  
[RU/US]; 14126 Heatherhill Place, Houston, TX 77077  
(US). BRISCO, David, Paul [US/US]; 405 Westridge  
Drive, Duncan, OK 73533 (US). WADDELL, Kevin  
[US/US]; 11007 Sprucedale Court, Houston, TX 77070  
(US). COOK, Robert, Lance [US/US]; 934 Caswell  
Court, Katy, TX 77450 (US).
- (74) Agents: MATTINGLY, Todd et al.; Haynes & Boone,  
LLP, Suite 4300, 1000 Louisiana Street, Houston, TX  
77002-5012 (US).
- (81) Designated States (national): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,  
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,  
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK,  
SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA,  
ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,  
ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK,  
TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,  
GW, ML, MR, NE, SN, TD, TG).
- Declaration under Rule 4.17:  
— of inventorship (Rule 4.17(iv)) for US only
- Published:  
— with international search report  
— before the expiration of the time limit for amending the  
claims and to be republished in the event of receipt of  
amendments
- (88) Date of publication of the international search report:  
5 August 2004

[Continued on next page]

(54) Title: ADJUSTABLE EXPANSION CONE ASSEMBLY



(57) Abstract: An adjustable expansion cone assembly.

WO 2003/023178 A3



---

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International application No.

PC1/US02/25608

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : E21B 43/10

US CL : 166/380,207

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 166/380,207,378, 212, 217, 242.6

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,420,866 A (MUELLER) 20 December 1983 (20.12.83), figures 1-4.	34-79

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

Special categories of cited documents:	
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" documents of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

17 October 2002 (17.10.2002)

Date of mailing of the international search report

24 MAY 2004

Name and mailing address of the ISA/US

Commissioner of Patents and Trademarks

Box PCT

Washington, D.C. 20231

Facsimile No. (703)305-3230

Authorized officer

David Bagwell

Telephone No. (703) 308-1113

**(19) World Intellectual Property  
Organization  
International Bureau**



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1

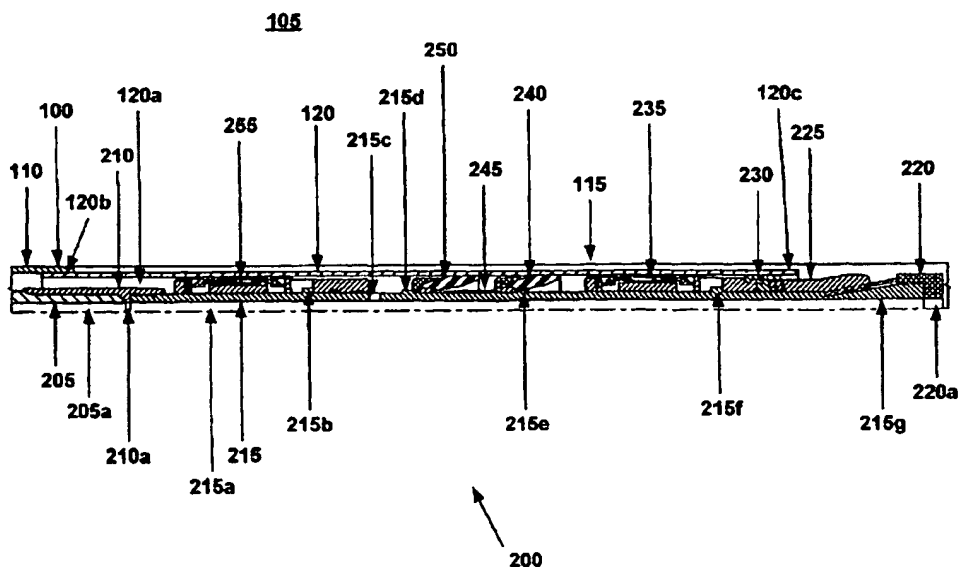
**PCT**

**(10) International Publication Number**  
**WO 2003/023178 A3**

- (51) International Patent Classification<sup>7</sup>: **E21B 43/10** (81) Designated States (*national*): AE, AG, AI, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (21) International Application Number: PCT/US2002/025608
- (22) International Filing Date: 13 August 2002 (13.08.2002)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 60/318,021 7 September 2001 (07.09.2001) US
- (71) Applicant (*for all designated States except US*): **ENVEN-TURE GLOBAL TECHNOLOGY** [US/US]; 16200 A. Park Row, Houston, TX 77084 (US).
- (72) Inventors; and
- (75) Inventors/Applicants (*for US only*): **RING, Lev** [RU/US]; 14126 Heatherhill Place, Houston, TX 77077 (US). **BRISCO, David, Paul** [US/US]; 405 Westridge Drive, Duncan, OK 73533 (US). **WADDELL, Kevin** [US/US]; 11007 Sprucedale Court, Houston, TX 77070 (US). **COOK, Robert, Lance** [US/US]; 934 Caswell Court, Katy, TX 77450 (US).
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SI, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Declaration under Rule 4.17:**  
— *of inventorship (Rule 4.17(iv)) for US only*
- Published:**  
— *with international search report*  
— *with amended claims*
- (88) Date of publication of the international search report: 5 August 2004
- Date of publication of the amended claims:** 16 September 2004
- (74) Agents: **MATTINGLY, Todd et al.**; Haynes and Boone, L.L.P. Suite 3100, 901 Main Street, Dallas, TX 75202-3789 (US).

[Continued on next page]

**(54) Title:** ADJUSTABLE EXPANSION CONE ASSEMBLY



**(57) Abstract:** An adjustable expansion cone assembly.

**WO 2003/023178 A3**



---

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## AMENDED CLAIMS

[Received by the International Bureau on 22 July 2004 (22.07.2004):  
original claims 1-79 unchanged ; claims 80-140 added (10 pages)]

means for increasing the outside diameter of the adjustable expansion cone assembly by displacing the actuator and the adjustable expansion cone assembly relative to the expandable tubular member in a second direction opposite to the first direction.

78. The apparatus of claim 77, wherein the means for displacing the actuator of the apparatus in the first direction comprises:

means for impacting the actuator.

79. The apparatus of claim 77, wherein the means for displacing the actuator and the adjustable expansion cone assembly relative to the expandable tubular member in the first direction comprises:

means for impacting the actuator.

80. A method of radially expanding and plastically deforming a tubular member, comprising:  
radially expanding at least a portion of the tubular member by increasing an operating pressure of a volume of a fluidic material contained by at least a portion of the tubular member; and  
radially expanding and plastically deforming at least a portion of the tubular member by displacing an expansion device within the tubular member.

81. The method of claim 80, wherein the volume comprises an annular volume.

82. The method of claim 80, wherein the expansion device is controllably adjustable from a first outside diameter to a second outside diameter.

83. An apparatus for radially expanding a tubular member, comprising:  
a tubular support member;  
an adjustable expansion device movably coupled to the tubular support member; and  
means for adjusting the adjustable expansion device.

84. The apparatus of claim 83, wherein the means for adjusting the adjustable expansion device comprises:  
frictional means for adjusting the adjustable expansion device.

85. The apparatus of claim 83, wherein the means for adjusting the adjustable expansion device comprises:  
resilient means for adjusting the adjustable expansion device.

86. An adjustable expansion device, comprising:  
a tubular support member;  
an adjustable expansion device movably coupled to the tubular support member, comprising:  
a plurality of expansion segments; and  
means for guiding the expansion segments on the tubular support member; and  
means for adjusting the adjustable expansion device.

87. The adjustable expansion device of claim 86, wherein the adjustable expansion device further comprises:  
means for interlocking the expansion segments.
88. The adjustable expansion device of claim 86, wherein the means for adjusting the adjustable expansion device comprises:  
resilient means for supporting the expansion segments.
89. The adjustable expansion device of claim 86, wherein the expansion segments include first and second interleaved groups of expansion segments.
90. The adjustable expansion device of claim 89, wherein the means for adjusting the adjustable expansion device comprises:  
means for displacing the first and second interleaved groups of expansion segments in opposite directions.
91. A method of operating an adjustable expansion device comprising a plurality of expansion segments, comprising:  
guiding the expansion segments on a tapered body; and  
controllably displacing the expansion segments along the tapered body.
92. The method of claim 91, further comprising:  
resiliently guiding the expansion segments on the tapered body.
93. The method of claim 91, further comprising:  
interlocking the expansion segments.
94. The method of claim 91, further comprising:  
dividing the expansion segments into first and second groups of expansion segments; and  
interleaving the first and second groups of expansion segments.
95. The method of claim 94, further comprising:  
overlapping the first and second groups of expansion segments.
96. The method of claim 94, wherein controllably displacing the expansion segments along the tapered body comprises:  
displacing the first and second interleaved groups of expansion segments in opposite directions.

97. A method of operating an adjustable expansion device comprising a plurality of expansion segments, comprising:
- guiding the expansion segments on a multi-sided tapered body;
  - interlocking the expansion segments; and
  - controllably displacing the expansion segments along the tapered body.
98. A method of operating an adjustable expansion device comprising a plurality of expansion segments, comprising:
- resiliently guiding the expansion segments on a multi-sided tapered body;
  - guiding each of the expansion segments on opposite sides in the circumferential direction;
  - interlocking the expansion segments; and
  - controllably displacing the expansion segments along the tapered body.
99. A method of operating an adjustable expansion device comprising a plurality of expansion segments, comprising:
- dividing the expansion segments into first and second groups of expansion segments;
  - interleaving the first and second groups of expansion segments;
  - overlapping the first and second groups of expansion segments;
  - resiliently guiding the expansion segments on a multi-sided tapered body;
  - guiding each of the expansion segments on opposite sides in the circumferential direction; and
  - controllably displacing the expansion segments along the tapered body.
100. A method of operating an adjustable expansion device comprising a plurality of expansion segments, comprising:
- dividing the expansion segments into first and second groups of expansion segments;
  - interleaving the first and second groups of expansion segments;
  - guiding the expansion segments on a multi-sided tapered body; and
  - controllably displacing the expansion segments along the tapered body while also relatively displacing the first and second groups of expansion segments in opposite directions.
101. A method of plastically deforming and radially expanding an expandable tubular member using an apparatus comprising a tubular support member, an adjustable expansion device movably coupled to the tubular support member, and an actuator movably coupled to the tubular support member for adjusting the adjustable expansion device, comprising:
- coupling a first end of the expandable tubular member to a tubular structure;
  - locking the actuator to the tubular support member of the apparatus;
  - inserting the apparatus into the first end of the expandable tubular member;
  - moving the actuator and the adjustable expansion device of the apparatus out of the second end of the expandable tubular member;
  - reinserting the actuator of the apparatus into the second end of the expandable tubular member;



unlocking the actuator from the tubular support member of the apparatus;  
rotating the actuator relative to the tubular support member of the apparatus; and  
increasing the outside diameter of the adjustable expansion device by moving the tubular support member relative to the actuator, the adjustable expansion device, and the expandable tubular member; and  
plastically deforming and radially expanding the expandable tubular member by moving the adjustable expansion device through the expandable tubular member.

102. The method of claim 101, wherein the tubular support member includes one or more lugs; wherein the actuator includes one or more corresponding retaining slots; and wherein locking comprises positioning the lugs into the corresponding retaining slots.

103. The method of claim 101, wherein the tubular support member includes one or more lugs; wherein the actuator includes one or more corresponding retaining slots; and wherein unlocking comprises positioning the lugs out of engagement with corresponding retaining slots.

104. The method of claim 101, wherein moving the tubular support member relative to the actuator, the adjustable expansion device, and the expandable tubular member comprises:  
the actuator frictionally engaging the expandable tubular member.

105. The method of claim 101, wherein moving the adjustable expansion device through the expandable tubular member comprises:  
pulling the adjustable expansion device through the expandable tubular member.

106. The method of claim 101, further comprising:  
fluidically sealing the interface between the tubular support member of the apparatus and the expandable tubular member;  
wherein moving the adjustable expansion device through the expandable tubular member comprises:  
injecting a pressurized fluid into the tubular support member.

107. A method of plastically deforming and radially expanding an expandable tubular member using an apparatus comprising a tubular support member, an adjustable expansion device movably coupled to the tubular support member, and an actuator movably coupled to the tubular support member for adjusting the adjustable expansion device, comprising:  
coupling a first end of the expandable tubular member to a tubular structure;  
inserting the apparatus into the first end of the expandable tubular member in a first direction;  
displacing the actuator of the apparatus in a second direction opposite to the first direction;  
applying a resilient biasing force to the adjustable expansion device in the second direction;  
moving the actuator and the adjustable expansion device of the apparatus out of the second end of the expandable tubular member;

reinserting the actuator of the apparatus into the second end of the expandable tubular member in the second direction;  
increasing the outside diameter of the adjustable expansion device by displacing the actuator and the adjustable expansion device relative to the expandable tubular member in the first direction;  
and  
plastically deforming and radially expanding the expandable tubular member by moving the adjustable expansion device through the expandable tubular member in the second direction.

108. The method of claim 107, wherein displacing the actuator of the apparatus in the second direction comprises:

impacting the actuator with the first end of the expandable tubular member.

109. The method of claim 107, wherein displacing the actuator and the adjustable expansion device relative to the expandable tubular member in the first direction comprises:

impacting the actuator with the second end of the expandable tubular member.

110. The method of claim 107, wherein moving the adjustable expansion device through the expandable tubular member comprises:

pulling the adjustable expansion device through the expandable tubular member.

111. The method of claim 107, further comprising:

fluidically sealing the interface between the tubular support member of the apparatus and the expandable tubular member;

wherein moving the adjustable expansion device through the expandable tubular member comprises:  
injecting a pressurized fluid into the tubular support member.

112. An adjustable expansion device, comprising:

a plurality of expansion segments;

means for guiding the expansion segments on a tapered body; and

means for controllably displacing the expansion segments along the tapered body.

113. The assembly of claim 112, further comprising:

means for resiliently guiding the expansion segments on the tapered body.

114. The assembly of claim 112, further comprising:

means for interlocking the expansion segments.

115. The assembly of claim 112, further comprising:

means for dividing the expansion segments into first and second groups of expansion segments; and

means for interleaving the first and second groups of expansion segments.

116. The assembly of claim 115, further comprising:  
means for overlapping the first and second groups of expansion segments.
117. The assembly of claim 115, wherein the means for controllably displacing the expansion segments along the tapered body comprises:  
means for displacing the first and second interleaved groups of expansion segments in opposite directions.
118. An adjustable expansion device, comprising:  
a plurality of expansion segments;  
means for guiding the expansion segments on a multi-sided tapered body;  
means for interlocking the expansion segments; and  
means for controllably displacing the expansion segments along the tapered body.
119. An adjustable expansion device, comprising:  
a plurality of expansion segments;  
means for resiliently guiding the expansion segments on a multi-sided tapered body;  
means for guiding each of the expansion segments on opposite sides in the circumferential direction;  
means for interlocking the expansion segments; and  
means for controllably displacing the expansion segments along the tapered body.
120. An adjustable expansion device, comprising:  
a plurality of expansion segments;  
means for dividing the expansion segments into first and second groups of expansion segments;  
means for interleaving the first and second groups of expansion segments;  
means for overlapping the first and second groups of expansion segments;  
means for resiliently guiding the expansion segments on a multi-sided tapered body;  
means for guiding each of the expansion segments on opposite sides in the circumferential direction;  
and  
means for controllably displacing the expansion segments along the tapered body.
121. An adjustable expansion device, comprising:  
a plurality of expansion segments;  
means for dividing the expansion segments into first and second groups of expansion segments;  
means for interleaving the first and second groups of expansion segments;  
means for guiding the expansion segments on a multi-sided tapered body; and  
means for controllably displacing the expansion segments along the tapered body while also relatively displacing the first and second groups of expansion segments in opposite directions.

122. An apparatus for plastically deforming and radially expanding an expandable tubular member, comprising:
- a tubular support member;
  - an adjustable expansion device movably coupled to the tubular support member;
  - means for actuating the adjustable expansion device;
  - means for locking the actuator to the tubular support member of the apparatus;
  - means for unlocking the actuator from the tubular support member of the apparatus;
  - means for increasing the outside diameter of the adjustable expansion device by moving the tubular support member relative to the actuator, the adjustable expansion device, and the expandable tubular member.
123. The apparatus of claim 122, wherein the tubular support member includes one or more lugs; wherein the actuator includes one or more corresponding retaining slots; and wherein the means for locking comprises positioning the lugs into the corresponding retaining slots.
124. The apparatus of claim 122, wherein the tubular support member includes one or more lugs; wherein the actuator includes one or more corresponding retaining slots; and wherein the means for unlocking comprises positioning the lugs out of engagement with corresponding retaining slots.
125. The method of claim 122, further comprising:
- means for fluidically sealing the interface between the tubular support member of the apparatus and the expandable tubular member.
126. An apparatus for plastically deforming and radially expanding an expandable tubular member, comprising:
- a tubular support member;
  - an adjustable expansion device movably coupled to the tubular support member;
  - means for actuating the adjustable expansion device;
  - means for displacing the actuator of the apparatus in a first direction;
  - means for applying a resilient biasing force to the adjustable expansion device when the actuator is displaced in the first direction;
  - means for increasing the outside diameter of the adjustable expansion device by displacing the actuator and the adjustable expansion device relative to the expandable tubular member in a second direction opposite to the first direction.
127. The apparatus of claim 126, wherein the means for displacing the actuator of the apparatus in the first direction comprises:
- means for impacting the actuator.

128. The apparatus of claim 126, wherein the means for displacing the actuator and the adjustable expansion device relative to the expandable tubular member in the first direction comprises:  
means for impacting the actuator.
129. An apparatus for radially expanding a tubular member, comprising:  
a tubular support member;  
an adjustable expansion cone assembly movably coupled to the tubular support member; and  
means for adjusting the adjustable expansion cone assembly;  
wherein the adjustable expansion cone assembly comprises one or more rigid moveable expansion cone segments.
130. An adjustable expansion cone assembly, comprising:  
a tubular support member;  
an adjustable expansion cone movably coupled to the tubular support member, comprising:  
a plurality of rigid expansion cone segments; and  
means for guiding the rigid expansion cone segments on the tubular support member; and  
means for adjusting the adjustable expansion cone.
131. A method of operating an adjustable expansion cone assembly comprising a plurality of rigid expansion cone segments, comprising:  
guiding the rigid expansion cone segments on a tapered body; and  
controllably displacing the rigid expansion cone segments along the tapered body.
132. A method of operating an adjustable expansion cone assembly comprising a plurality of rigid expansion cone segments, comprising:  
guiding the rigid expansion cone segments on a multi-sided tapered body;  
interlocking the rigid expansion cone segments; and  
controllably displacing the rigid expansion cone segments along the tapered body.
133. A method of operating an adjustable expansion cone assembly comprising a plurality of rigid expansion cone segments, comprising:  
resiliently guiding the rigid expansion cone segments on a multi-sided tapered body;  
guiding each of the rigid expansion cone segments on opposite sides in the circumferential direction;  
interlocking the rigid expansion cone segments; and  
controllably displacing the rigid expansion cone segments along the tapered body.
134. A method of operating an adjustable expansion cone assembly comprising a plurality of rigid expansion cone segments, comprising:  
dividing the rigid expansion cone segments into first and second groups of rigid expansion cone segments;

interleaving the first and second groups of rigid expansion cone segments;  
overlapping the first and second groups of rigid expansion cone segments;  
resiliently guiding the rigid expansion cone segments on a multi-sided tapered body;  
guiding each of the rigid expansion cone segments on opposite sides in the circumferential direction;  
and  
controllably displacing the rigid expansion cone segments along the tapered body.

135. A method of operating an adjustable expansion cone assembly comprising a plurality of rigid expansion cone segments, comprising:  
dividing the rigid expansion cone segments into first and second groups of expansion cone segments;  
interleaving the first and second groups of expansion cone segments;  
guiding the expansion cone segments on a multi-sided tapered body; and  
controllably displacing the expansion cone segments along the tapered body while also relatively displacing the first and second groups of expansion cone segments in opposite directions.
136. An adjustable expansion cone assembly, comprising:  
a plurality of rigid expansion cone segments;  
means for guiding the rigid expansion cone segments on a tapered body; and  
means for controllably displacing the rigid expansion cone segments along the tapered body.
137. An adjustable expansion cone assembly, comprising:  
a plurality of rigid expansion cone segments;  
means for guiding the rigid expansion cone segments on a multi-sided tapered body;  
means for interlocking the rigid expansion cone segments; and  
means for controllably displacing the rigid expansion cone segments along the tapered body.
138. An adjustable expansion cone assembly, comprising:  
a plurality of rigid expansion cone segments;  
means for resiliently guiding the rigid expansion cone segments on a multi-sided tapered body;  
means for guiding each of the rigid expansion cone segments on opposite sides in the circumferential direction;  
means for interlocking the rigid expansion cone segments; and  
means for controllably displacing the rigid expansion cone segments along the tapered body.
139. (Original) An adjustable expansion cone assembly, comprising:  
a plurality of rigid expansion cone segments;  
means for dividing the rigid expansion cone segments into first and second groups of expansion cone segments;  
means for interleaving the first and second groups of rigid expansion cone segments;

means for overlapping the first and second groups of rigid expansion cone segments;  
means for resiliently guiding the rigid expansion cone segments on a multi-sided tapered body;  
means for guiding each of the rigid expansion cone segments on opposite sides in the circumferential direction; and  
means for controllably displacing the rigid expansion cone segments along the tapered body.

140. An adjustable expansion cone assembly, comprising:  
a plurality of rigid expansion cone segments;  
means for dividing the rigid expansion cone segments into first and second groups of expansion cone segments;  
means for interlaving the first and second groups of rigid expansion cone segments;  
means for guiding the rigid expansion cone segments on a multi-sided tapered body; and  
means for controllably displacing the rigid expansion cone segments along the tapered body while also relatively displacing the first and second groups of rigid expansion cone segments in opposite directions.

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**